Summary.

The claim of Dr. F. F. Friedmann to have originated a specific cure for tuberculosis is not substantiated by our investigation.

The claim of Dr. F. F. Friedmann that the inoculation of persons and animals with his organism is without harmful possibilities is disproved.

BACTERIOLOGICAL STANDARD FOR DRINKING WATER.

THE STANDARD ADOPTED BY THE TREASURY DEPARTMENT FOR DRINKING WATER SUPPLIED TO THE PUBLIC BY COMMON CARRIERS IN INTERSTATE COMMERCE.

Pursuant to the recommendation of the Surgeon General, the Treasury Department on October 21, 1914, adopted a bacteriological standard for drinking water for the purpose of the administration of the Interstate Quarantine Regulations as they relate to the drinking water supplied to the public by common carriers in interstate commerce. The following is the letter of promulgation:

TREASURY DEPARTMENT,
Washington, October 21, 1914,

The SURGEON GENERAL, PUBLIC HEALTH SERVICE,
Washington, D. C.

SIR: You are informed that, in accordance with your recommendation of October 21, 1914, the department has adopted the bacteriological standard recommended by a commission appointed by the Secretary of the Treasury January 22, 1913, to recommend standards of purity for drinking water supplied to the public by common carriers in interstate commerce.

This standard is described in the first progress report of the commission, copy of which is attached hereto.

In the future common carriers will be required to furnish water for passengers in interstate traffic which will conform to this standard.

Respectfully,

W. G. MCADOO, *Secretary.*

The standard is one recommended by a commission appointed for the purpose by the Secretary of the Treasury January 22, 1913. The commission was composed of the following members:

John F. Anderson.....Director Hygienic Laboratory, chairman of the commission, Washington, D. C.
Edward Bartow.....Director, Illinois Water Survey, Urbana, Ill.
Charles C. Bass.....Director, Laboratory of Clinical Medicine, Tulane University, New Orleans, La.
S. J. Crumbine.....Secretary State Board of Health, Topeka, Kans.
Edward C. Franklin.....Professor of Chemistry, Leland Stanford Junior University, Stanford University, Cal.
Henry Hanson.....Bacteriologist, State Board of Health, Jacksonville, Fla.
Charles Gilman Hyde.....Professor of Sanitary Engineering, University of California, Berkeley, Cal.

Edwin O. Jordan.....Professor of Bacteriology, University of Chicago, Chicago, Ill.
Allan J. McLaughlin.....Surgeon, Public Health Service, Washington, D. C.
William H. Park.....Director, Research Laboratories, Department of Health, New York City.
Milton J. Rosenau.....Professor of Preventive Medicine and Hygiene, Harvard University, Boston, Mass.
William T. Sedgwick.....Professor of Biology, Massachusetts Institute of Technology, Boston, Mass.
George C. Whipple.....Professor of Sanitary Engineering, Harvard University, Cambridge, Mass.
C.-E. A. Winslow.....Curator, Department of Public Health, American Museum of Natural History, New York City.
Wade H. Frost.....Passed Assistant Surgeon, Public Health Service, recorder of the commission, Washington, D. C.

The following is the standard recommended by the commission and adopted by the Department of the Treasury:

The Bacteriological Standard for Water.

The following are the maximum limits of permissible bacteriological impurity:

1. The total number of bacteria developing on standard agar plates, incubated 24 hours at 37° C., shall not exceed 100 per cubic centimeter. Provided, that the estimate shall be made from not less than two plates, showing such numbers and distribution of colonies as to indicate that the estimate is reliable and accurate.

2. Not more than one out of five 10 cc. portions of any sample examined shall show the presence of organisms of the bacillus coli group when tested as follows:

(*a*) Five 10 cc. portions of each sample tested shall be planted, each in a fermentation tube containing not less than 30 cc. of lactose peptone broth. These shall be incubated 48 hours at 37° C. and observed to note gas formation.

(*b*) From each tube showing gas, more than 5 per cent of the closed arm of fermentation tube, plates shall be made after 48 hours' incubation, upon lactose litmus agar or Endo's medium.

(*c*) When plate colonies resembling *B. coli* develop upon either of these plate media within 24 hours, a well-isolated characteristic colony shall be fished and transplanted into a lactose-broth fermentation tube, which shall be incubated at 37° C. for 48 hours.

For the purposes of enforcing any regulations which may be based upon these recommendations the following may be considered sufficient evidence of the presence of organisms of the *Bacillus coli* group.

Formation of gas in fermentation tube containing original sample of water (*a*).

Development of acid-forming colonies on lactose litmus agar plates or bright red colonies on Endo's medium plates, when plates are prepared as directed above under (*b*).

The formation of gas, occupying 10 per cent or more of closed arm of fermentation tube, in lactose peptone broth fermentation tube inoculated with colony fished from 24-hour lactose litmus agar or Endo's medium plate.

These steps are selected with reference to demonstrating the presence in the samples examined of aerobic lactose-fermenting organisms.

3. It is recommended, as a routine procedure, that in addition to five 10 cc. portions, one 1 cc. portion, and one 0.1 cc. portion of each sample examined be planted in a lactose peptone broth fermenfation tube, in order to demonstrate more fully the extent of pollution in grossly polluted samples.

4. It is recommended that in the above-designated tests the culture media and methods used shall be in accordance with the specifications of the committee on standard methods of water analysis of the American Public Health Association, as set forth in "Standard Methods of Water Analysis" (A. P. H. A., 1912).

The standard as recommended by the commission was submitted with the following report discussing the question of standards of purity for water in general:

First Progress Report of Commission Appointed to Recommend Standards of Purity for Drinking Water Supplied to the Public by Common Carriers Engaged in Interstate Traffic.

LIMITS OF PERMISSIBLE BACTERIOLOGICAL CONTAMINATION.

More than a year has been devoted to consideration and discussion of the problems raised in this connection; but, since the discussion has of necessity been conducted solely through correspondence progress has inevitably been slow, so that, even after so long a time, there remains a number of questions upon which satisfactory agreement has not yet been reached. Your commission, not wishing, on the one hand, to curtail free discussion of points upon which satisfactory agreement has not been reached, nor, on the other hand, to further delay submitting such recommendations as have been agreed upon, respectfully request that this report, though incomplete, be accepted and utilized pending the rendering of a more complete report dealing with questions not included herein.

As a preface to the recommendations which follow it is desired that a clear distinction be made between "standards of purity" and

"limits of permissible impurity." Since purity is an absolute, not a relative, quality, it is obvious that there can be no "standard of purity" other than absolute purity; that this must be the point of departure in estimating deviations from purity or degree of impurity. The recommendations here presented are limits of permissible impurity; they are in no sense "standards of purity." They are recommended not as the nearest approximation to purity which it is desirable to attain; but, on the contrary, as the furthest deviations from purity considered permissible on the water supplies with which this report deals. In this connection it is desired also to emphasize the statement that these limits of impurity are recommended only for application to the special case in question; that is, the control of the sanitary quality of the water supplies of common carriers.

The problem before the commission has been to recommend limits of permissible impurities such as to meet the following requirements:

1. That water supplies conforming to the prescribed requirements shall be free from injurious effects upon the human body and free from offensiveness to the sense of sight, taste, or smell.

2. That supplies of the quality required shall be obtainable by common carriers without prohibitive expense.

3. That the examinations necessary to determine whether a given water supply meets the requirements shall be as few and as simple as consistent with the end in view.

In the attempt to establish limits of this kind it has been inevitable that manifold difficulties should have been encountered. The first of these is the difficulty inherent in any attempt to establish an exact line of demarcation between two such extremes as undoubtedly safe water supplies and those which should assuredly be condemned. This difficulty is enhanced by the necessity of defining uniform limits for waters from such diverse sources and subject to such varied conditions of storage as are the supplies of common carriers, and is still further enhanced by the necessity of limiting to a practicable minimum the number and kind of examinations upon which judgment must be formed. It is a fact so well established as to need no further discussion that the results of bacteriological and chemical examination of a sample of water ought always to be correlated with a knowledge of the source, treatment, and storage of the supply in order to enable a just estimate of the sanitary quality of such supply. With a full appreciation of this fact it is, nevertheless, necessary for our purpose to define limits based solely on the results of laboratory examinations, since it is often in practice impracticable to obtain first-hand authoritative information regarding the source and han-

dling of the supplies of common carriers as actually distributed to the public. The effect of eliminating a portion of the desirable information is to necessitate somewhat more liberal limits for permissible amounts of impurities which are not actually and definitely injurious and which are removable only at great cost, and narrower limits for permissible impurities of definitely dangerous character.

In regard to the physical and chemical properties which render water disagreeable to sight, taste, or smell without producing any concrete harmful effect a difficulty is encountered in that the degree of offensiveness is not accurately measurable, being largely dependent upon individual taste and habits. Again, regarding many of the constituents found in natural waters, as, for example, various mineral salts, it is impossible in the present state of our knowledge to definitely specify the ill effects, if any, which given amounts of these substances may product. Limits upon these impurities must, accordingly, be so placed as to allow the public an ample margin of safety; but to do this raises the question as to how far it is justifiable to tax the carriers to eliminate impurities whose deleterious effects are so doubtful. This question is the more difficult since it is generally impracticable to remove the mineral salts present in waters by measures of practicable application, and consequently narrow limits to the permissible amounts of such substances will have the effect of eliminating many sources of supply—sources which will frequently be the only ones readily available and may yield waters conforming with entire satisfaction to the other more important sanitary requirements. Finally it is in regard to permissible amounts of mineral constituents that the greatest difficulty is encountered in framing such requirements as shall require only simple methods of examination for their enforcement.

It is because of these difficulties and because of the minor sanitary importance of regulating the chemical impurities of water supplies that these questions have been left for further discussion and this report drafted to deal only with the more important question of regulating bacteriological impurities.

The definition of limits for the permissible bacteriological pollution of the water supplies in question is at once more important and simpler than defining limits for permissible chemical impurities. It is more important because the most dangerous of all the impurities which may be present in drinking water are disease-producing bacteria and other parasitic disease germs. It is simpler than the other problems mentioned, because as the result of a vast deal of careful study which has been devoted to the bacteriological quality of water supplies and their effects upon the public health it is now possible to define with reasonable precision what constitutes a bacteriologically

safe water supply. Finally, strict regulations, requiring common carriers to provide water of undoubtedly safe bacteriological quality, are thoroughly justified, because where water of the requisite degree of purity is not obtainable from a convenient natural source, it is entirely practicable to obtain a pure supply from a moderately polluted source by comparatively simple and inexpensive processes of purification. The art of water purification has, in fact, progressed to the point where there is no longer any excuse whatsoever for using bacteriologically polluted water.

The vast majority of the bacteria found in drinking water supplies are entirely harmless, and regulations designed to insure freedom from disease-producing bacteria must, accordingly, be concerned more with the character than the numbers of the bacteria present. The isolation of the disease-producing bacteria which may be present even in highly polluted waters is so nearly impossible, because of the difficulty of separating them from the much more numerous harmless bacteria with which they are associated, that in actual practice the attempt to directly demonstrate the presence of disease-producing bacteria is seldom made. The bacteriological examination of water supplies has therefore been developed, rather, along the line of determining the number and proportion of certain broad classes of bacteria present in a given volume of water, namely:

1. Bacteria developing distinct colonies within 48 hours at 20° C. on standard gelatin culture medium.

2. Bacteria which developed distinct colonies within 24 hours at 37° C. on standard agar culture medium.

3. Bacteria belonging to the *bacillus coli* group.

It is beyond the scope of this report to enter into a detailed discussion of the interpretation of results of bacteriological examination of water supplies. In general, reliable interpretations can be made only by those having a sufficiently broad knowledge of bacteriology to enable them to apply the established general principles to each case as it is presented.

The bacteria developing on standard gelatin at 20° C. include a relatively large proportion of harmless bacteria which are normally inhabitants of soils and natural waters free from dangerous pollution. The number of bacteria, as estimated by the standard gelatin count, serves in a general way as an index of the cleanliness of the sample; but to properly interpret the results of such a count it is necessary to have knowledge of the source of the sample examined, the nature of the pollution to which it has been exposed, and the opportunities afforded for multiplication of the harmless varieties of bacteria present. On account of the rapid multiplication of harmless varieties of bacteria, which may take place when water is stored in small containers at moderate temperatures,

and the impossibility of making approximately correct allowance for such multiplication, it is belived that the attempt to establish a limit for bacteria developing on gelatin is not practicable for the purposes of the control of supplies of common carriers.

The bacteria developing on standard agar at 37° C. in 24 hours are also chiefly varieties which are entirely harmless. The agar count, however, as compared with the gelatin count, represents a larger proportion of bacteria which find their normal habitat in the animal body and are present in sewage and other discharges from the animal body. Generally speaking, an excessive agar count is sufficient to cause at least a suspicion that the water is polluted with discharges from the animal body, and is therefore unsafe for use as drinking water. Multiplication of the harmless varieties present may, however, take place at ordinary temperatures in water stored in tanks, coolers, bottles, and other containers, thus greatly increasing the agar count, without, of course, increasing the actual dangerous pollution of the water. This introduces a large source of error into the attempt to interpret the significance of agar counts of samples of waters stored for varying lengths of time under conditions more or less favorable to bacterial multiplication. It is largely for this reason that it has been considered necessary to allow very liberal limits to the agar count of the water supplies of common carriers, and to attach to the results of this method of examination a significance much less than ordinarily attaches to the agar count in examining samples of water freshly removed from known sources.

Bacteria of the *bacillus coli* group are normally inhabitants of the intestinal tract of warm-blooded animals, and it is believed that under ordinary conditions they do not multiply, in nature, outside of the animal body; that in drinking water supplies they tend, on the contrary, to die out rather rapidly. The presence of such bacteria in water may accordingly be considered valid evidence that the water has been polluted with the intestinal discharges of some of the higher animals and the numbers present may be considered a fair index of the extent of such pollution. Since practically all of the diseases which are known to be commonly transmitted through water supplies are due to germs which are discharged from the intestines of infected persons, pollution with intestinal discharges is not only the most offensive but by far the most dangerous kind of pollution to which water supplies are exposed.

It is obviously desirable that drinking waters should be at all times entirely free from such offensive and dangerous pollution, but it would be both impracticable and unnecessary to enforce a requirement that the supplies of common carriers should always be entirely

free from bacteria of the *bacillus coli* group. The test is an extremely delicate one, showing traces of pollution not detectable by any other means; all surface waters are naturally subject to more or less pollution with animal excreta, and experience has shown that efficient purification, rendering originally polluted waters entirely safe and satisfactory, never extends to the point of constantly and entirely removing all bacteria of the bacillus coli group.

The limits recommended for permissible pollution of this character are as rigid as it is possible to make them without, on the one hand, requiring absolute freedom from such bacteria or, on the other hand, increasing materially the cumbersomeness of the examinations necessary to ascertain compliance with the requirements. Compliance with the requirements herein recommended will insure a quality of water supplies equal to that of municipal supplies which have been demonstrated by experience to be entirely safe and satisfactory and will at the same time impose no great burden upon common carriers, since it is entirely practicable, with moderate expense and pains, to purify water to the degree required.

In submitting the recommendations herewith presented it may be again emphasized that the limits defined are recommended with reference solely to the special object of the control of the supplies of common carriers, having in mind that these supplies constitute a special case because of the following reasons:

1. The supplies come from widely diversified and mixed sources.

2. Samples taken from common carriers represent waters stored for various lengths of time under varying conditions.

3. In view of the impossibility of accurately ascertaining the source and history of each supply examined reliance must be placed upon results of laboratory examination to a greater extent than is necessary or justified in estimating the quality of a supply from a known source with a known history.

It is requested that the recommendation of these hard-and-fast limits of bacteriological impurity be not interpreted as minimizing in any way the importance of field surveys in estimating the sanitary quality of water supplies in general. It is always desirable to obtain information from as many angles as possible, and this is, indeed, necessary in order to form an altogether fair estimate of an individual supply.

Pending the preparation of the report recommending specific limits for permissible chemical impurities, it is recommended that water supplies which may be bacteriologically sanitary be excluded from use when, in the opinion of the Surgeon General, they are definitely injurious to health or grossly offensive by reason of chemical impurities or physical properties.